

### **DETAILED ACTION**

This Office action is in response to a telephonic correspondence conducted on January 20, 2011 with Applicant. The final Office action mailed on October 18, 2010 and the Advisory action mailed on December 27, 2010 (which denied the after-final amendment filed by Applicant on December 17, 2010) indicated that claims 1, 2, 4-8, 10-14, 16 and 17 would be allowable if rewritten or amended to overcome the rejection under 35 U.S.C section 112, 2<sup>nd</sup> paragraph as well as various claim objections set forth in the Office action. In the telephonic correspondence, Applicant authorized the cancellation of claim 15 and the amendment of claims 1, 2, 4 and 16 via Examiner's amendment to place the claims in condition for allowance.

### ***Information Disclosure Statement***

The information disclosure statement (IDS) submitted on December 17, 2010 was filed after the mailing date of the Office action on October 18, 2010. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

### **EXAMINER'S AMENDMENT**

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with B.J. Sadoff on January 20, 2011.

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The application has been amended as follows:

**Claim 1 (Currently Amended)** A spray pyrolysis method for the synthesis of closed-structure nanoparticles of metal chalcogenides having a lamellar crystallographic structure, of the general formula (I)  $M_aX_b$ , said method comprising the steps of:

(a) providing a solution of at least one precursor having the [of] formula (II)  $(A)_cM(X)_d$  dissolved in a solvent,

(b) providing a liquid aerosol by atomizing the solution obtained in step a) into fine droplets in suspension in an inert carrier gas, and

(c) pyrolyzing the liquid aerosol obtained in step c); wherein, in formulas (I) and (II):

A represents a cation,

M represents a transition metal or a metal from group III, IV or V of the periodic table of the elements,

X represents a chalcogen selected from oxygen, sulfur, selenium and tellurium,

a and b each represents the proportion of metal and of chalcogen, respectively, in formula (I),

c and d each represents the proportion of cations and of chalcogens, respectively, in formula (II),

M and X represent a metal and a chalcogen, respectively, of a metal chalcogenide  $M_aX_b$  having a lamellar crystallographic structure.

**Claim 2 (Currently Amended)** The method as claimed in claim 1, said method comprising the following steps:

**forming said [formation of a]** solution of said at least one precursor **having the [of]** formula (II) in a solvent,  
**atomizing [atomization of]** said solution in liquid aerosol form by a nebulizer, through which the carrier gas is flowing,  
**injecting [injection of]** the aerosol into a heated furnace to evaporate the solvent and to react and/or break down said at least one precursor **having the [of]** formula (II) so as to form the nanoparticles,  
**transporting [transport by the carrier gas of]** the nanoparticles to the furnace outlet **using the carrier gas,** and  
**recovering [recovery of]** the nanoparticles at the furnace outlet.

**Claim 4 (Currently Amended)** The method as claimed in claim 1, wherein A is  $K^+$ ,  $Na^+$  or  $NH_4^+$ [,].

**Claim 15 (Canceled)**

**Claim 16 (Currently Amended)** The method as claimed in claim 2, wherein the **nebulizer [negulizer]** is a pneumatic or ultrasonic type nebulizer.

***Allowable Subject Matter***

Claims 1, 2, 4-8, 10-14, 16 and 17 are allowed.

The following is an examiner's statement of reasons for allowance:

Laine et al. (US 5,958,361) disclose a method of synthesizing metal oxide crystalline nanoparticles by means of spray pyrolysis (see Abstract). The method comprises the steps of forming a solution comprising a metal oxide precursor (e.g. glycolato polymetallooxane) dissolved in a polar solvent (e.g. ethanol) (see lines 4-10, col. 11), aerosolizing the solution, conveying the aerosol to a furnace using nitrogen gas (see lines 30-35, col. 16), and converting the aerosol to crystalline nanoparticles having sizes ranging between 10-100 nm (see line 36, col. 17). The metal of the metal oxide can be Group III metals such as gallium and indium; Group IV metals such as tin and germanium; or transition metals such as hafnium, vanadium, cobalt, tungsten and chromium (see lines 11-25, col. 9). However, Laine et al. do not disclose the use of a precursor having the claimed formula  $(A)_cM(X)_d$  to form metal chalcogenides.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to PAUL S. HYUN whose telephone number is (571)272-8559. The examiner can normally be reached on Monday-Friday 8AM-4:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, In Suk Bullock can be reached on (571)-272-5954. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/Paul S Hyun/  
Examiner, Art Unit 1772

/In Suk Bullock/  
Supervisory Patent Examiner, Art Unit 1772